

Observations on the occurrence and habits of juvenile fishes in the nearshore region of the Mandapam area^{1 & 2}

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During 1952-55, I made a study of the juvenile fishes and their habits in the nearshore region in the Mandapam area. The study, confined mainly to the Palk Bay was facilitated largely because of the existence of a fishery exclusively for juvenile fishes, although data from other sources were also available. The present account deals with juveniles observed in the region up to about 2 km from shore during the period referred to above.

Studies were undertaken in the Palk Bay along a 5 km stretch of the coast between Munakkad and Pullamadam, and in the Gulf of Mannar at a point opposite the jetty of the Central Marine Fisheries Research Institute. Three sources of data were available for this account: (i) The commercial fishery, (ii) Experimental light fishing conducted by the C.M.F.R. Institute, and (iii) Independent observations undertaken by me during weekly sea trips at night.

(i) *The commercial fishery*: Juveniles are landed mainly by torch and hand-net boats (operated at night) and shore-seines (Sekharan 1955), the catches being greater during the new moon periods than during other periods. Another net operated is *Ola Valai*, a small shore-seine with the dragging ropes on either side having long dry palmyrah leaves attached to them. Observations on the fishery were conducted along the Palk Bay coast.

(ii) *Experimental light fishing*: Chellappa (1959) has described the experimental light fishing conducted in the Gulf of Mannar at Mandapam. On a number of occasions I also made observations on the fishes caught by this method.

(iii) *Independent personal observations*: During weekly sea trips at night, observations were made of fishes attracted by the light from

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a 2-cell electric torch and also of fishes in the near-shore region.

Data on the important species represented in the catches are based exclusively on the samples collected from the landings of torch-and-hand-net boats and shore-seines. Samples were taken, usually once a week, at night and preserved in formalin. In the laboratory, they were sorted into species, and the total length measured. The methods adopted for estimating the landed weight and number of the two important species of *Sardinella* which comprised the bulk of the landed catch of young fishes have been described elsewhere (Sekharan 1971).

The juveniles described here measure generally less than 70 mm. In terms of numbers and weights of all species combined, their period of peak occurrence in the Palk Bay is March-June, and only that period is referred to here in respect of the Palk Bay. In respect of the Gulf of Mannar the period referred to is January-April.

About 60 species of young fishes have been identified in the near-shore region, all common to the fish fauna of both the Palk Bay and the Gulf of Mannar. The more common species and their length ranges are given in the table.

OBSERVATIONS ON THE SHOALS OF JUVENILES

Shoals of young fishes which consisted mostly of *Sardinella* spp. and *Stolephorus* spp., and which are easily recognised as luminescent patches, were either stationary or showed random movement. The noise or vibration caused by the outboard engine (10 HP) used did not seem to scare the fish, inasmuch as no sudden movement could be noted when I collected plankton samples either directly over the shoals or very close to them.

On a few occasions, I was able to watch the sardine shoals in different stages of encirclement by the shore-shine. The shoals touching the wide-meshed part of the wing (made of coir rope) do not show any tendency to escape; instead individual fishes could be seen darting to and fro, seeming to peck at the net and then withdrawing, when the area enclosed by the net is very wide. On the other hand, when the enclosed area becomes smaller and smaller, the fish begin to escape from the net, and could easily be collected with a cloth (Sekharan 1959). In other words, the tendency to escape seems caused not so much by a slight obstruction in the path of the shoal, but by the limitation of the area of movement. A similar reaction has been inferred from studies of demersal fishes (Manteufel & Radakov 1964).

During March-June, the sardines are less than 65 mm on the average and are not normally found at the surface during day-time

TABLE

Gear	Species	Length-range (mm)
	<i>Sardinella albella</i> (Val.)	18—70
	<i>Sardinella gibbosa</i> (Bleeker)	18—70
	Other <i>Sardinella</i> species	20—70
	<i>Hilsa kelee</i> (Cuvier)	25—65
Torch-and hand-net. (Palk Bay)	<i>Stolephorus indica</i> (Van Hasselt)	15—60
	<i>Stolephorus</i> spp.	10—65
	<i>Gerres filamentosus</i> Cuv. & Val.	25—60
	<i>Gerres</i> spp.	30—70
	<i>Leiognathus splendens</i> (Cuv.)	10—70
	<i>Leiognathus</i> spp.	8—60
	<i>Atherina</i> spp.	30—70
Shore-seine (Palk Bay & Gulf of Mannar)	The species mentioned above, plus	
	<i>Ilisha</i> spp.	50—75
	<i>Escualosa thoracata</i> (Val.)	40—60
	<i>Thrissocles</i> spp.	30—70
	<i>Selaroides leptolepis</i> (Cuv. & Val.)	20—60
	Other <i>Caranx</i> spp.	25—65
	<i>Hemirhamphus</i> spp.	60—80 (from lower jaw)
	<i>Cypselurus</i> sp.	65—80
	<i>Platycephalus</i> spp.	50—65
	<i>Plotosus</i> spp.	50—75
	<i>Upeneus</i> spp.	55—75
	<i>Teuthis</i> spp.	60—75
	<i>Pelates</i> sp.	30—60
	<i>Sillago</i> sp.	30—65
	<i>Mugil</i> spp.	20—60
	<i>Scomberomorus</i> spp.	65—90
<i>Ola valai</i> (Palk Bay)	<i>Psammoperca waigaiensis</i>	40—80
	<i>Lethrinus</i> spp.	50—200
	<i>Lutianus</i> spp.	50—200
	<i>Leiognathus</i> spp.	20—75
	<i>Lactarius</i> sp.	30—80
Experimental: light fishing (Gulf of Mannar)	<i>Sardinella gibbosa</i>	60—90
	<i>Stolephorus</i> spp.	40—65
	<i>Ilisha</i> spp.	60—80
	<i>Leiognathus</i> spp.	30—65
	<i>Gazza</i> spp.	30—60
	<i>Plotosus</i> spp.	60—90

(Sekharan 1959). It would appear that the shoals break up or migrate to deeper waters during day-time. But after June, the shoals are spotted near the surface during day-time also; a change of habit with increase in size is thus apparant.

OBSERVATIONS ON THE REACTIONS OF JUVENILES TO LIGHT

(i) *In the fishery*: In the fishery using light, torches made of dried palmyrah leaves are employed. When a torch is lighted near a luminescent patch (shoal), the juveniles rapidly move towards it and around the boat. The torch is held about $1\frac{1}{2}$ metres above the surface of the water. The fishes, especially the sardines, anchovies and *Atherina* spp. even jump towards the light. Sometimes they crowd the entire near-shore region right up to the water's edge. Stationed about 75 metres from a palmyrah torch, I could collect thousands with the bucket of a $\frac{1}{2}$ m plankton net.

(ii) *During experimental light fishing*: First a 300 cc kerosene petromax light was used above the surface of the water. This was later substituted by an electric bulb, with power varying from 100 to 400 watts. Later on, a submerged light with power ranging from 6 to 21 watts was used. A dip net was arranged beneath the light. It was noted that "while the submerged light by itself was not effective, a combination of this with surface illumination gave a much bigger catch than either of the lights used singly" (Chellappa 1959). Only occasionally were sardines and anchovies seen in the catches; moreover they came in ones and twos and not in shoals. *Plotosus* spp. on the other hand appeared in groups of 10-15.

(iii) *Independent experiments conducted during this study*: An ordinary electric torch (with two cells) was used in the Palk Bay on dark nights. As soon as the beam strikes the water surface, *Atherina* spp. jump out of the water. When the beam moves along the surface, the fish along the track jump out, and falling back, create a sound like the patter of rain drops falling on water surface. Sardines were not seen during these trials, probably because they move in groups and not as individuals. Other fishes were not observed in the course of these trials.

In the evenings small sized *Mugil* spp. were seen along the water's edge in the Palk Bay and Gulf of Mannar.

IMPORTANT FISHES IN THE NEARSHORE REGION

The data collected showed that *Sardinella* spp., *Hilsa kelee* and *Stolephorus* spp. comprise the bulk of the juveniles (about 85%) in

the nearshore region, during the March-June period. Among them, *Sardinella* spp. are dominant, in terms of both numbers and mass. To some extent, this may be correlated with the food of these fishes.

Food of important species of juveniles: On a few occasions the stomach contents of different species of fishes from the nearshore region were examined. The important elements are mentioned below:

<i>Sardinella</i> spp.	<i>Hilsa kelee</i>	<i>Stolephorus</i> spp.
Copepod nauplii and Copepodites	Copepods Zoea	<i>Lucifer</i> spp. Copepods
Copepods	Lamellibranch larvae	Other Crustacea
Zoea	Diatoms (only small quantities)	
Lamellibranch larvae		
Gastropod larvae		
Diatoms		
Dinoflagellates		
<i>Ilisha</i> spp.	<i>Leiognathus</i> spp.	<i>Gazza</i> spp.
Copepods	Copepods	Copepods
Larger crustaceans	Decapod larvae	Decapod larvae
Diatoms (very few)	Diatoms (very few)	Diatoms (very few)

It may be seen that the conformity of the food spectrum with net plankton is more in the case of *Sardinella* spp. than in the case of other species, which explains, at least partly, the dominance of the former in the nearshore region.

The relative importance of *Sardinella albella* and *S. gibbosa*: Of the species of *Sardinella*, only *Sardinella albella* and *S. gibbosa* are important, the others forming less than 0.5 per cent of the sardine catch. Between the two species, *S. albella* is the more important one, on seasonal average. The ratio between the two species (in numbers) in 1952, 1953, 1954 and 1955 respectively was 7:2, 7:3, 20:19 and 13:12 in torch-and hand-net catches, and 3:2, 7:8, 17:12 and 1:5 in shore-seine catches.

DISCUSSION

Since *Sardinella* spp. comprised the bulk of the biomass of juveniles in the nearshore region, the entire group may be termed the "*Sardinella* complex". It would be interesting to find whether *Sardinella* spp. are associated with the same or related species in other regions of the east and west coasts of India.

As *Sardinella* spp. occupy a lower trophic level than other fishes, the dominance of the former in the nearshore region is explicable. But

the dominance pattern between the two species of *Sardinella* in the nearshore region cannot be satisfactorily explained in terms of feeding relationships alone. Both species occur in the same haul, feed on identical items with little indication of any item being taken more by one species than by the other (Sekharan 1970). Ivlev's (1961) experiments show that the feeding of a species in an area may be adversely affected by the mere presence of another species; the effect would obviously be reflected in the magnitude of the two populations in the area. It is also generally contended by ecologists that two species with the same ecological requirements cannot co-exist in the same habitat (Gause's theory). Therefore, on these considerations, equal abundance of the two species in the area is not to be expected. But the seasonal data indicate near parity in the relative abundance of the two species. This is of course not true of short-term periods within a season, for which the pattern is not constant; the dominant species was *Sardinella albella* in some periods but *S. gibbosa* during others, both in numbers and in biomass. Viewed in this light, the situation here would not run counter to Gause's theory.

It was however apparent that the balance between the two species was delicate and could even be upset in the future. In the Gulf of Mannar, *S. gibbosa* was the dominant species of *Sardinella* while in the Palk Bay, the inter-specific 'struggle' for dominance appeared to be still on. A reversal of the observed pattern of species abundance in the Palk Bay could therefore be visualised.

The Palk Bay fishery for juveniles is a good example of commercial sampling of young fishes. Considerable time and expense are involved in the scientific survey of juveniles in fishery biological work. If commercial fisheries on the Palk Bay model could be established in areas where young fish are suspected to congregate, it would be advantageous in fisheries research work.

The recent decline in torch-and hand-net fishing (Dr. R. V. Nair, personal communication) calls for a serious study. Compared to the 1950's the character of the fisheries in the Palk Bay had changed considerably in 1960's with a concomitant increase in mechanisation of boats. The fishery for *Leiognathus* spp. is of much greater importance now-a-days than formerly. If the abundance of sardines has declined, it has to be determined to what extent the decrease is fishery-dependent. Similarly the effect, if any, of the recent changes in the fishing methods in the Palk Bay on the eco-system and the balance of the populations there merits an investigation.

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